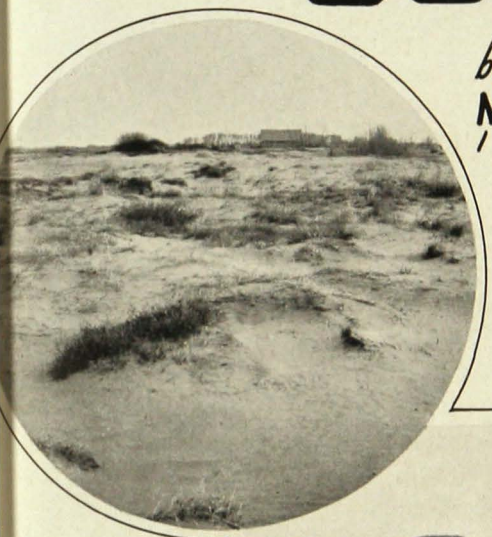
WIND EROSION CONTROL

by M. A. THORFINNSON



Left—Unwise land use caused these dunes

Right—Proper land use on the same type of soil prevented wind erosion

UNIVERSITY OF MINNESOTA
Agricultural Extension Service
U. S. DEPARTMENT OF AGRICULTURE

What Do You Know About Wind Erosion?

This test has been prepared to enable Minnesota Agricultural Extension Bulletin readers to check their knowledge of wind erosion. All questions are based on information given in this bulletin. In taking the test, place the number of the correct answer in the space provided after each question. Answers are given on the back page. An average score for anyone who has read the bulletin is 9 correct, an excellent score is 11 correct.

1. How many acres of Minnesota land have been affected by drifting during drouth years? (1) 100,000 (2) one million (3) five million or more (.....)
2. On what type of soil is wind erosion most severe? (1) Sandy (2) Silt loam (3) Clay loam (.....)
3. What is the ideal hay combination in a rotation in most drifting areas? Alfalfa and (1) Brome (2) Bluegrass (3) Sweet clover (.....)
4. Why is grass recommended in a mixture with alfalfa for erosion control? (1) Improves hay quality (2) Adds fibrous roots to soil (3) Adds nitrogen to soil (.....)
5. What rotation will give best control on severely drifting soils? (1) corn-grain-hay (2) corn-corn-grain-hay (3) corn-grain-hay-hay-hay (.....)
6. In strip cropping for wind erosion control, should all strips be plowed at the same time? (Yes or no) (.....)
7. In strip cropping on sandy soils, about how many rods wide should the strips be? (1) 3-5 (2) 10-14 (3) 20-25 (.....)
8. What is the maximum width recommended for strips in wind erosion control? (1) 15 (2) 22 (3) 34 rods (.....)
9. Should land subject to erosion be plowed less often than usual? (Yes or no) (.....)
10. What is the principal advantage of subsurface tillage in controlling erosion? (1) Leaves crop residue on surface (2) Increases water percolation (3) Decreases evaporation (.....)
11. What farmers have the least trouble with drifting soil? (1) Dairy (2) Grain (3) Beef and hog (.....)
12. What is subsurface tillage? (1) Tillage of subsoil (2) Moldboard plowing (3) Tillage at plow depth without disturbing surface (.....)

Wind Erosion Control

FROM FIVE to twelve million acres of Minnesota land have been affected by drifting during drouth years. Even heavier soils have drifted at times especially when the land was summerfallowed or planted to intertilled crops; and on lighter soils, dunes have formed as a result of unwise land use.

Conditions favoring soil drifting are strong winds; open country without natural barriers; loose, dry soil; lack of cover of either crops or crop residue; and insufficient organic matter and plant roots in the soil.

Strong winds cannot be stopped, but drifting can be controlled by good management and proper handling of crops and soils. Control methods are simple and need not upset the present farming program. Briefly these practices are:

1. **Wise land use**
2. **Crop rotations with legumes and grasses**
3. **Strip cropping in 10- to 20-rod fields**
4. **Rough tillage or subsurface tillage to maintain a stubble mulch**
5. **Field shelterbelts (windbreaks) to protect cropland**
6. **Moisture conservation**

On silt loams or on some heavy sandy loams less subject to drifting, crop rotation and strip cropping might be effective. However, on most drifting soils at least three of the practices are needed, and on severely drifting soils a combination of all is necessary.

Cooperation Necessary

In some of the more severely drifting areas, cooperation between farmers is essential because soil drifting from one farm may interfere with the control program on an adjoining farm.

The problem varies with the weather, soil, and size and type of farms. In northwestern Minnesota the relatively low average annual precipitation and long dry periods in the spring and early summer make the problem more difficult. Because soils drift more readily when dry, such dry periods in the spring often result in serious damage to newly seeded crops even on loam and clay soils.

Sandy soils drift most readily. Severe drifting has occured in two large, sandy areas, one along and between the beach lines of old glacial Lake Agassiz

FIG. 1. DUNE FORMATION IN ANOKA COUNTY. THIS LAND NEVER SHOULD HAVE BEEN PLOWED

in the Red River Valley and the other a somewhat triangular shaped area north of the Twin Cities in Isanti, Anoka, Sherburne, Benton, and eastern Stearns counties. Many smaller areas of sandy soils occur throughout the state.

Silt loams and heavier soils also drift quite readily especially where summer fallow is practiced or intertilled crops such as potatoes and sugar beets are grown. When these soils are permitted to blow, the finer soil particles are carried away by the wind while the coarser particles drift along the surface. This action may gradually coarsen or even remove the topsoil. The loams, silt loams, and even clay soils of the Red River Valley and the prairie soils of southwestern Minnesota may drift occasionally. This, however, is not a problem except during dry seasons.

Wind erosion is worst in level areas with few trees where the wind gets an unobstructed sweep for a long distance. Hills and trees afford considerable protection especially to small fields, but the large farms in the prairie region have large fields with little or no such protection. When intertilled crops are planted on these large fields, it is much more difficult to control drifting.

The type of farming practiced is also important. Large scale grain farms using fallow or corn in the rotation have a much more serious problem than small scale dairy farms. The larger percentage of hay and pasture in the rotation on the dairy farms helps to check soil drifting. The substitution of the so-called "sweet clover fallow" for black fallow in the grain farming area is beneficial in decreasing spring and early summer drifting since either the sweet clover or sweet clover stubble is plowed under early in June. On the other hand, the increase in the potato and sugar beet acreage has intensified the wind erosion problem on many farms.

Wise Land Use

THE FIRST approach to the problem is wise land use. There are some sandy areas that drift so readily that it is more profitable to keep them in permanent woodland or meadow than to cultivate them. On many farms there are such areas that are not suitable for cropland. Each farmer can classify his own soil as to its capabilities and limitations and then handle it accordingly.

On land not suited to cropping the farmer has at least three choices.

1. If he has a dairy or general livestock farm, he may need this land for **permanent hay or pasture.** For hay this would mean seeding a permanent

FIG. 2. DRIFTED LINE FENCE IN NORMAN COUNTY. COMMUNITY COOPERATION IS NEEDED HERE

legume and grass mixture. If used for pasture, it would mean not only seeding a permanent pasture but also managing this pasture so as to avoid overgrazing.

2. If the farmer does not need roughage from this land, he can put it into **permanent grasses** to be harvested for seed such as Kentucky bluegrass.

3. The farmer who does not already have a **wood lot** to supply wood, lumber, and fence posts might prefer to plant such land to trees.

The use of cropland should also be planned carefully using some in less intensive rotations with a maximum amount of hay or rotation pasture and some of the land least subject to drifting for the more intensive rotations with intertilled crops.

Crop Rotations

A CROP rotation with legume and grass hay or rotation pasture helps check drifting. The number of years in hay crop will vary with erodibility of the soil. In some cases it might be only two years out of five, such as corn or potatoes, two years of grain, and two years of hay. At the other extreme it might be desirable to use five years of hay, one of corn, and one of grain or possibly two of grain with no corn.

In most drifting areas, the ideal hay combination in a rotation is alfalfa and brome grass. This would be left from three to five years depending on the amount of roughage the farmer could use profitably. If a rotation with two years of hay is wanted, alfalfa and timothy may be used, or on the heavier sandy loams and heavier soils, red clover and timothy. Crested wheat grass may be used either alone, with alfalfa, or with brome and alfalfa especially on the sands and loamy sands. The legume in these mixtures supplies nitrogen to the soil, and the grass supplies fibrous roots. These roots branching and rebranching in the soil help to restore the granular structure usually found in virgin prairie soils and have a binding effect on the soil when it is plowed.

Brome is one of the best grasses for binding soil; crested wheat grass and timothy are also quite effective. Kentucky bluegrass is rather shallow rooted and not nearly as effective in holding the topsoil as the other grasses mentioned when plowed under.

Brome Widely Adapted

Brome is adapted anywhere in Minnesota, but because of high cost of seed it is best suited to longer rotations or for permanent hay and pasture. Timothy is adapted in most of the state though it does not do so well west of

FIG. 3. CONTOUR STRIPS 125 FEET WIDE

the timber line in the Red River Valley or in some parts of west central Minnesota. Crested wheat has the most limited range in Minnesota. It has done well on the University's sand experimental fields in Anoka and Beltrami counties and at the Grand Rapids Experiment Station.

It is sound practice in sandy areas to grow as much alfalfa hay and pasture as possible. If a good pasture mixture is established and a good pasture program worked out, this is the most economical feed to grow. Dairy or livestock farmers on the heavier sandy loams may be able to use enough hay and pasture in the rotation to control their drifting problem with crop rotation alone. However, on farms with large acreages of corn, beets, potatoes, or other intertilled crops, other control measures besides crop rotation will probably be needed for successful control.

Seeding Legumes and Grasses

If rotation and strip cropping programs are to be successful, good stands of legumes and grasses are essential. Establishing good stands is not as difficult on loams and heavier soils as on the sandy soils. Sufficient moisture at the time of seeding and thorough packing either just before or immediately after seeding are especially important. Fall plowed land is preferable because it packs over winter, but even this needs some packing. Here the cultipacker has proven effective. The double gang with seeder attachment or single gang with broadcast seeding is recommended on soils which are subject to drifting. On soils where drifting is serious, it may also be necessary to maintain a stubble mulch by saving the crop residues from the preceding crop.

Cover Crops

Where a large percentage of intertilled crops is used in the rotation, cover crops are useful in checking drifting in the fall, winter, and early spring.

Winter rye is the cover crop most commonly used. In the areas where early potatoes are grown this is a good practice because the rye not only prevents drifting but also provides some green manure for the succeeding crop. In regions of light rainfall some farmers prefer oats because oats make a quicker start and do not take moisture from the succeeding crop. The dead oat plants are quite effective in controlling spring drifting. On fields where corn is removed early for ensilage or fodder, the same practice may be followed.

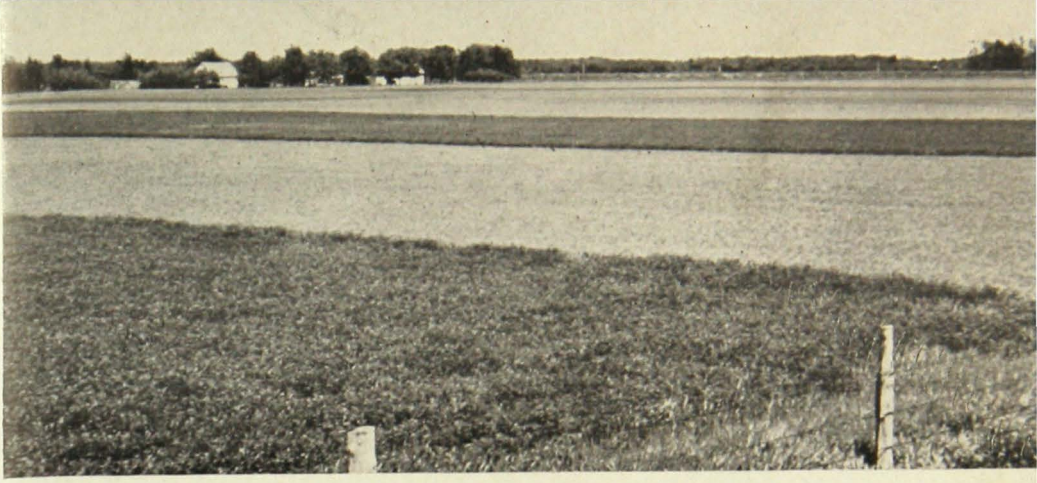


FIG. 4. STRIP CROPPING SAVES MANY FARMS FROM WIND EROSION

Strip Cropping

STRIP CROPPING has proven effective when combined with a crop rotation in which the crops are alternated so that at least one strip in three is a protective strip such as hay or a winter grain crop.

The following principles should be observed as far as possible:

1. **Have one strip in three in hay or winter grain.**
2. **Avoid having two strips of intertilled crops side by side.**
3. **Avoid plowing two strips at the same time. Plow one strip in the fall, the other in the spring, or plow for spring grain earlier than for corn.**
4. **Strips should run east and west unless shape of farm or natural barriers interfere.**

Strip cropping cuts down on the width of land bare at any one time; it decreases the rate of evaporation even on the bare strips because the wind blows across the protective strips; and it checks the wind's force near surface.

Alternating crops and plowing at different times prevent leaving a wide area bare at one time. If plowing for spring grain is done in the spring, it is often possible to have the grain seeded or even up before plowing for corn.

The term, strip cropping, as used in the Northern Great Plains area, often means a strip of grain and a strip of fallow. In Minnesota it is definitely linked up with a crop rotation in which hay and winter grain form the protective strips with corn or other intertilled crops and spring grains between.

Width of Strips

The width of strips will vary with the type of soil.

On sandy soils that drift more readily, 10 to 13⅓ rods is preferable.

On sandy loams and silt loams, strips may be 16 to 20 rods wide. The width will depend partly on the rotation used because that will largely determine the number of fields desired.

On most silt loams and heavier soils, the 20-rod width is used because farmers prefer the larger fields. Also, this divides a half section or a square quarter into eight fields or a long quarter into four fields which fits four-year rotations commonly used. Where a five-year rotation is wanted, the 16-rod width can be used.

East-West Strips Preferable

Field strips usually should be laid out east and west in Minnesota because the strong prevailing winds are from the northwest, northeast, southwest,

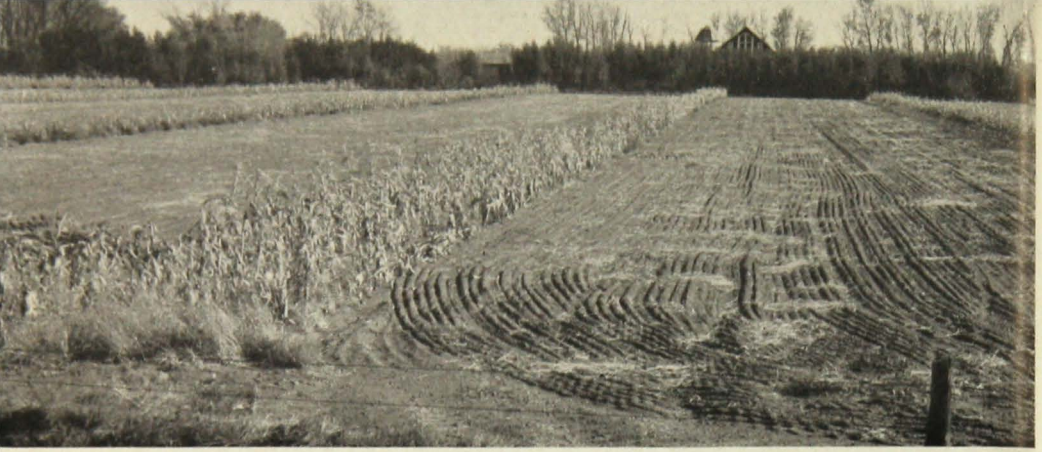


FIG. 5. BUFFER STRIPS OF CORN HELP CHECK DRIFTING

and south. If the strips are laid out north and south, the hot south winds may do a great deal of damage. However, on some farms it may be more convenient to have the strips north and south, either because of natural barriers or location of the farmstead. In some cases it may be most convenient to lay out the strips parallel to a low area which is being used for hay or pasture. If this results in S-shaped or winding strips, it would not be objectionable because these would give protection no matter which way the wind might blow.

Contour Strips

Contour strips may be used for control of both wind and water erosion where fairly uniform strips can be laid out on, or nearly on, the level. These are usually from 60 to 120 feet wide for the control of water erosion and therefore are narrow enough to be effective in controlling wind erosion. Since most sandy soils absorb water rather rapidly, contour strips would probably not be required unless the slope is over 3 per cent and 10 or 15 rods long.

Contour lines are usually laid out with a hand level and the strips staked out as near as possible to the contour without making them too uneven in width. For details on laying out contour lines write to Bulletin Room, University Farm, or ask your local county agent for Extension Folder 108, "Contour Strip Cropping."

Buffer Strips

Buffer strips of four rows of corn help check drifting in potato and beet fields. The corn is husked and the stalks left standing. This gives protection even in late fall and catches considerable snow during the winter. Such buffers sometimes give considerable protection to the sugar beet field even during the summer the beets are planted because the intensive cultivation of beet fields may result in drifting early in the season.

Rough Tillage and Stubble Mulch

CULTIVATING soil so as to leave a rough, cloddy surface—preferably with trash cover or stubble mulch—helps check wind erosion. The main advantages of rough tillage are:

1. **It decreases wind velocity at the surface of the soil.**
2. **The clods and crop residues prevent soil particles from breaking up as easily into fine particles that drift readily.**
3. **It increases the rate of percolation and decreases runoff.**

FIG. 6. (LEFT) THE ONE-WAY DISK TILLER LEAVES STUBBLE PARTIALLY ON SURFACE (RIGHT) THE TANDEM DISK LEAVES STUBBLE MULCH ON SURFACE

A clod mulch is easier to establish and maintain on the silt loams than on the lighter sandy soils. Hence, a stubble mulch is particularly needed on the latter. Stubble mulch, however, has a place on the heavier soils since it still gives protection after the clods break up.

Plow Less Often

The following program is suggested for plowing:

1. Plow less frequently.
2. If you have a one-way disk tiller or wide sweeps, use these in place of moldboard plow for summer fallow, fall plowing, and even in spring seedbed preparation for grain.
3. If you do not have these implements, use a duckfoot cultivator, tandem disk, or disk harrow.
4. Where you have to use a moldboard plow, follow with subsurface packer or basin tilling implement to firm and roughen the surface.

STUBBLE MULCH

One-Way Disk Tiller

The one-way disk tiller has proven valuable in preventing wind erosion. By turning combine stubble, other crop residues, and weeds only partially under, it leaves a rough surface with a stubble mulch which is ideal for fallow or fall plowing. Such a surface can be turned into an ideal seedbed for grain by use of the subsurface packer or the press drill. However, the one-way disk tiller should not be used more than once during the same season on fallow land because it may cover the crop residues and pulverize the soil too much. The one-way disk tiller also has limitations on binder stubble, and care must be taken to set it so it will not cover the stubble. Too high speed may also cover the stubble.

Disk Harrow

The tandem disk can also be used on stubble successfully by setting it so it only partly covers the stubble. This leaves the ground with a stubble mulch to catch snow. Usually it packs sufficiently over winter so grain can be seeded without further cultivation. The ordinary disk harrow can be used on stubble without serious drifting by single disking, but it leaves the ground in ridges.

In combine stubble or heavy binder stubble, double disking may be done without pulverizing the soil too much. Under these conditions the disk with the large 20- to 22-inch disks has some advantage.

FIG. 7. (LEFT) FIELD CULTIVATOR WITH DUCKFOOT SHOVELS SHOWING WORK IN COMBINE STUBBLE (RIGHT) THE ECCENTRIC OR OFFSET-MOUNTED BASIN DISK

Return Crop Residues to Soil

Do not burn crop residues. They should be returned to the soil. Crop residues not only add fertility and humus but also help provide a stubble mulch to prevent drifting. Grain stubble, corn stubble, and even potato vines can, in most cases, be turned under. By using the cut-away coulter or the 18-inch coulter instead of the regular rolling coulter, combine stubble can usually be handled without clogging. If not, it might be better to use the disk tiller or the disk. The common practice of burning poato vines is one of the reasons why potato land blows so readily.

On soils that drift, barnyard manure may be disked in so as to mix it with the surface soil. From the standpoint of crop yields, manure is about as effective when disked in as when plowed under, and at the same time disking in has a definite advantage in controlling soil drifting.

Cutivation to Maintain Stubble Mulch

All cultivation of fallow or fall plowed land should be done as far as possible with implements that will maintain a rough surface with a protective cover of crop residues. The disk harrow, spring tooth harrow, and various types of field cultivators may be used effectively. Some sandy soils have enough fine material in them so that cultivation when wet helps produce a cloddy surface. Cultivation that ridges the surface helps check drifting even when no clods are formed. Effective cultivation to kill weeds can be done without burying the weeds, especially with some of the newer types of cultivators.

SUBSURFACE TILLAGE

Subsurface tillage can be done with various types of tillage implements. Most of these cultivate 3 to 5 inches below the surface while leaving the crop residues on the surface.

Cultivator with Duckfoot Shovels

The most common implement of this type in Minnesota is the field cultivator equipped with duckfoot shovels or 10- to 12-inch sweeps.

The wide duckfoot type shovels are quite effective in killing weeds while leaving the surface almost undisturbed. With different types of shovels the field cultivator can be used to ridge the soil to check drifting.

Implement manufacturers are now manufacturing wider sweeps (18 to 24 inches wide), and many of them are

FIG. 8. (LEFT) THE BASIN TILLER ROUGHENS THE SURFACE
(RIGHT) THE PRESS DRILL PACKS LIKE A SUBSURFACE PACKER

also making heavier built field cultivators to use these wide sweeps. A few are equipped with a rolling coulter ahead of each sweep to prevent the cultivator from clogging in combine stubble.

Plow Sweeps

Sweeps, 23 to 24 inches wide, are available which can be attached on any moldboard plow in place of the share and moldboard. One of the advantages of these plow sweeps is the lower cost to the farmer who may not have a field cultivator, since he can equip his plow for subsurface tillage operations for a nominal cost.

Blade Weeders

Various types of blade weeders have been used during the past for subsurface tillage. Nebraska dynamometer tests indicate that these are comparable to the wide sweeps in draft. Compared to the moldboard plow and one-way disk tiller, the blade or the sweep type of implements required from one third to one half the power per foot of blade when operated at 4- to 4½-inch depth in the Nebraska tests. The blade weeders do much the same work as the wide sweeps.

The principal advantage of subsurface tillage is the control of soil erosion through crop residues left on the surface. On most soils it will increase the percolation of water into the soil and thus conserve moisture that would otherwise run off. It may also have some effect in decreasing evaporation.

Subsurface tillage instead of plowing may result in somewhat lower yields in wet years in Minnesota. Yields following the one-way disk tiller, however, have been equal to those of the moldboard plow.

CULTIVATION TO ROUGHEN SURFACE

As a regular practice on some farms it may be advisable to use implements that will roughen the surface to check drifting. The eccentric- or offset-mounted basin disk and the basin tiller are coming into use particularly on the heavier soils of the Red River Valley and to some extent on the sandy soils. They are effective in checking drifting on fall plowing, fallow, or on potato fields where the soil has been left too loose by the digger. Both are light draft, especially the basin tiller. The basins formed are rather shallow and may drift full again but many farmers prefer to go over the field a second time with machines of this type rather than to use the basin listers

FIG. 9 (LEFT) THE SUBSURFACE PACKER
(RIGHT) STRAW MULCH IS SUCCESSFULLY ANCHORED WITH SUBSURFACE PACKER

which would probably have to be used only once during the season. Other basin-forming implements are now on the market.

The soil also may be ridged with field cultivators with every other shovel (or two out of three) removed. The small shovel lister with shovels 2 feet apart instead of 4 feet apart is quite effective for ridging the soil but it requires somewhat more power. Damming attachments are also available for these listers.

SUBSURFACE PACKING

Subsurface packers have wide-spaced, wedge-shaped steel wheels which pack below the surface. Clods 2 to 3 inches below the surface may even be forced to the surface by the wedging action of the wheels. Subsurface packers make an excellent seedbed following the one-way disk tiller, disk harrow, or field cultivators equipped with duckfoot type shovels or the wide sweeps. The subsurface packer is very effective in anchoring stubble, straw, or any crop residues to prevent drifting.

Where subsurface tillage has been used leaving a heavy stubble mulch on the surface other types of rollers and packers, especially the cultipacker may be used to advantage. These machines are also effective in getting stands of alfalfa and grasses, but should be used with caution on sandy soils where there is little or no stubble mulch cover.

PRESS DRILL

The press drill is in itself a packer and packs in a way similar to the subsurface packer. It has the advantages of packing, leaving the soil ridged to check drifting, and probably giving the seed a little quicker start. The packing of the soil in the drill row next to the seed gives it the benefit of any available moisture and hence a quicker start. Many of the manufacturers now have press attachments available that can be attached to regular drills.

Field Shelterbelts

FIELD SHELTERBELTS are usually effective in checking soil drifting to a distance of about 20 times the height of the tallest trees in the shelterbelt. However, the effective distance varies with length and density of barrier, velocity of wind, and soil type. A series of field shelterbelts across a farm would result in more effective control.

Farmers who have a wind erosion problem should make plantings at least on the south and west sides of the farm. If the boundary is a highway

FIG. 10 (LEFT) FIELD SHELTERBELTS HELP CHECK DRIFTING
(RIGHT) SNOW RIDGING YOUNG SHELTERBELTS CONSERVES MOISTURE

such shelterbelts should be 150 feet or more away from the center of the highway. The strip between the highway and the field shelterbelt can be seeded to permanent hay. Plantings of three to five rows are recommended for these shelterbelts. The planting would then consist of one to three rows of tall trees with a row of dense shrubs to each side. The shelterbelt should include at least one row of the faster growing species such as native poplar, cottonwood, or willow and one of green ash in the center.

Additional plantings can then be made of two- or three-row shelterbelts across the farm between fields at intervals of 40 to 80 rods, depending on severity of the erosion problem and whether the farmer can spare the land from grain and hay crops. Such a pattern of shelterbelt plantings across many adjoining farms would give the maximum benefit to all farms in the area.

Moisture Conservation

SHELTERBELTS, hedges, and buffer strips conserve moisture through catching and holding snow. The effectiveness of this winter moisture depends on how deep the ground is frozen, how fast the snow melts, and how rapid the runoff is. A covering of stubble or even a stubble mulch helps prevent deep freezing and a rough surface helps check runoff and increases the rate of percolation. Hence, a combination of control practices is most effective.

Snow fences have been used to conserve winter moisture and prevent soil drifting, but they are relatively expensive.

Snow Ridging

Recently snow ridging has had good results in the Red River Valley. A series of ridges of snow are thrown up with a snow plow 1 or 2 rods apart as soon as there is enough snow on the ground. This is repeated as more snow falls. The value of this practice depends on how much of the melting snow is retained in the soil within reach of the crops. In the case of perennial crops, this would all be used. In the case of annual crops, most or all of this moisture would be used on the heavier soils, but some would be lost on sandy soils.

Implements for Moisture Conservation

Various types of implements have been used to leave the soil in a condition to catch rainfall and melting snow as well as to help hold snow in the winter. Most farmers object to basins as deep as those made by the large

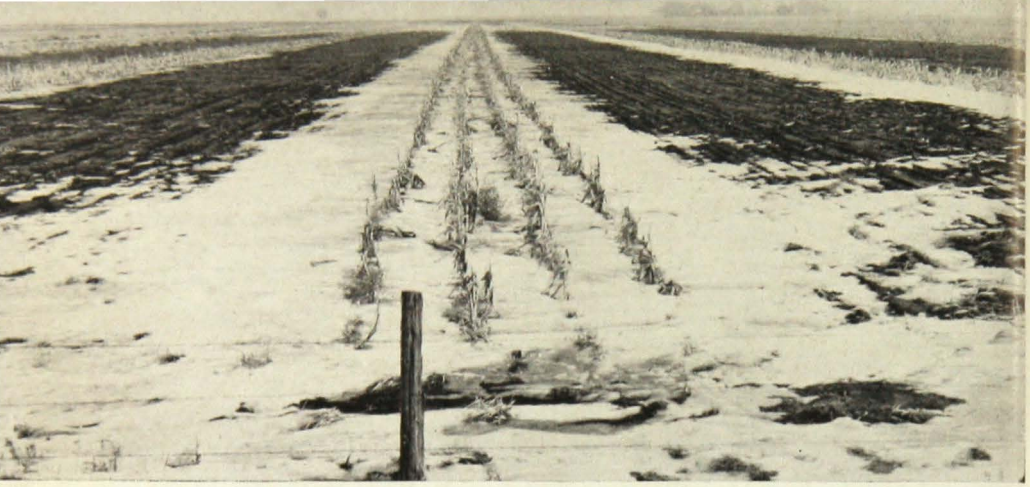


FIG. 11. CORN BUFFER STRIPS CATCH SNOW IN WINTER

shovel basin lister. The implements which make shallower basins are preferable under our conditions. Among these are the basin tiller, eccentric- or offset-mounted basin disk, and the small shovel basin lister with the shovels about 2 feet or less apart. Many ridging implements, such as the field cultivators with every other shovel removed, also help catch snow but are not so effective in holding rainfall or spring runoff.

Emergency Measures

ON SOILS subject to severe wind erosion, years of extreme drouth may require emergency measures. Blowouts and dune formations are not easily controlled, and it may take several years to reclaim such land for agricultural use. Even then it may be fit only for woodland, hay, grass seed, or controlled grazing.

Listing

Listing is one of the most effective ways of checking drifting until some crop can be started and a cover established. On steep land listing should be on the contour to avoid starting field gullies. On gently rolling land the basin lister may often be used without following the contour.

If corn or sorghum cane is planted on listed ground in Minnesota, it is usually preferable to plant on the ridges so the plants will make a quicker start.

Grain fields that drift severely may often be saved by listing every 30 to 40 feet. The one-way disk tiller with every other disk removed may be used in the same way. Other ridging implements can be used for this purpose. The ridges may be smoothed later with only a small part of the grain damaged.

Cultivate To Save Corn

Corn fields may drift severely before the corn is tall enough to give protection, especially after a rain. An effective method used by many farmers in sandy areas is to start cultivating immediately and cover the field as quickly as possible, taking every fourth row. This checks the movement of soil particles along the surface and gives all the young plants some protection until the entire field can be cultivated. The same practice may be used on other intertilled crops.

Sorghum Cane Helps Establish Cover

One of the most valuable crops in reclaiming dune areas is sorghum cane. After listing, this can be planted in rows on the ridges. It seems to thrive

FIG. 12. (LEFT) HOW THE BASIN LISTER OPERATES
(RIGHT) WORK OF THE BASIN LISTER

better than any other crop on drifting sandy soils. If conditions are favorable, it may produce some fodder in addition to establishing a cover which will hold the soil until more permanent types of vegetation can be started.

Mulching Reclaims Dune Areas

Mulching with straw or manure on blowout spots or knolls has been used effectively by many farmers. Usually this has been used only on rather small areas. However, it may also be done on areas of 5 to 50 acres without too much cost if the spreading is done from hay racks spreading the straw with the wind. The straw is anchored in the soil with the subsurface packer or disk. If a disk is used, it should be weighted down with rocks or sandbags and the disks set almost straight. This method may also be used to stop drifting in a grain field in the spring or early summer or before seeding to legumes and grasses on fields that drift readily.

As all emergency measures are expensive, it is more efficient to develop a control program on the farm that will prevent the severe damage that makes such measures necessary.

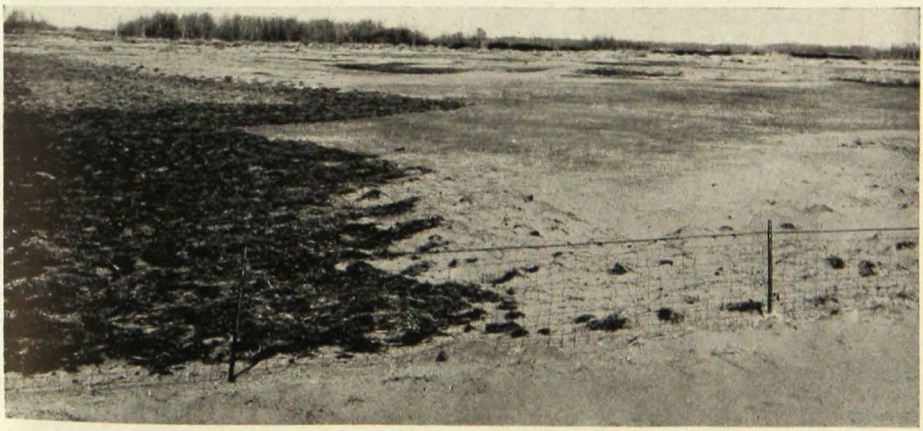


FIG. 13. THE LEFT PART OF THIS DUNE AREA IS STABILIZED WITH STRAW AND MANURE MULCH

More Bulletins for You

If this bulletin has been of interest and help to you, perhaps you would like to know about other useful publications that are obtainable from the Agricultural Extension Service, either direct or through your local county extension office. A postcard or letter addressed to Bulletin Room, University Farm, St. Paul, will bring you a complete list of titles to choose from. And if you wish, ask to be placed on the mailing list for quarterly announcements of new bulletins.

Some other extension publications valuable to persons interested in soil erosion and general farm problems are:

Bulletin 218—Feeding the Dairy Herd
Bulletin 197—Pasture Plants and Combinations
Folder 62—Legume and Grass Mixtures
Folder 84—Getting Alfalfa Stands on Sandy Soil
Folder 107—Grassed Waterways
Folder 108—Contour Strip Cropping

ANSWERS TO QUIZ

1. ..... (3)	5. ..... (3)	9. ..... (Yes)
2. ..... (1)	6. ..... (No)	10. ..... (1)
3. ..... (1)	7. ..... (2)	11. ..... (1)
4. ..... (2)	8. ..... (2)	12. ..... (3)

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